

MATHEMATICAL PROCESS—REASONING AND PROVING



THE ONTARIO CURRICULUM, MATHEMATICS, 2005

Students will develop and apply reasoning skills (e.g., recognition of relationships, generalization through inductive reasoning, use of counter-examples) to make mathematical conjectures, assess conjectures and justify conclusions, and plan and construct organized mathematical arguments.

Students make sense of mathematics through reasoning. An organized, analytical, well-reasoned approach to learning mathematical concepts and processes and to solving problems requires an emphasis on reasoning.

ROLE OF STUDENTS

Hypothesize/make conjectures

- Combine given information with intuition to make a reasoned guess when prompted.
- Refine hypothesis as evidence is gathered.

Make inferences, conclusions and justifications

- Use models and logic to infer/conclude.
- Reason inductively by considering specific cases and identifying patterns.
- Analyze and evaluate the mathematical thinking and strategies of others.
- Present arguments in a logical and organized manner.
- Try multiple examples.
- Look for a case that does not work, i.e., a counter-example.

SAMPLE QUESTIONS

- How can we show that this is true for all cases?
- In what cases might our conclusion not hold true?
- How can we verify this answer?
- Explain the reasoning behind your prediction.
- Why does this work, e.g., the procedure for bisecting an angle using compasses?
- What do you think will happen if this pattern continues?
- Show how you know that this statement is true.
- Give an example of when this statement is false.
- Explain why you do not accept the argument as proof.
- How could we check that solution?
- What other situations need to be considered?

SAMPLE FEEDBACK

- What you have presented is true for the cases you considered. Explain some cases where this situation will not be true.
- Present your solution, showing all the steps so someone else will understand your thinking.
- Your reasoning was good to this point in your argument. Study your next point to see if you can identify the flaw in reasoning.
- Identify the flaw in this argument. How would you correct it?
- How does this reasoning follow from what you said?
- Before you implied, and now you are saying. How can both be true?